

Description of Work to be Performed in Support of the Project to Validate AT-SAT as a Placement Tool

1.0 Purpose

The purpose of this procurement is to obtain expert services, for the Civil Aerospace Medical Institute (CAMI) Aerospace Human Factors Research Division (AAM-500), required to complete a concurrent, criterion-related validation study that examines the potential use of the Federal Aviation Administration's Air Traffic Selection and Training (AT-SAT) computerized test battery as a tool to inform decisions about the placement of new hires into different controller options. The expert services required are for the collection of criterion performance data and AT-SAT predictor data from 500 incumbent air traffic control tower controllers. The Federal Aviation Administration (FAA) will use the results of this validation study together with results from a previous validation study, conducted to examine the relationship between AT-SAT scores and job performance in en route ATC, to develop rules for initial placement of new controllers into terminal or en route air traffic control facilities.

2.0 Background

2.1 The controller job. Air traffic control specialists (ATCSs, "air traffic controllers" or "controllers") are assigned to work in one of two broad options of facilities requiring a similar skill set: en route centers (Air Route Traffic Control Centers, or ARTCCs) that control air traffic between airports; and terminal facilities, which control traffic near and at airports. The terminal option can further be divided into Terminal Radar Approach Control (TRACON) controllers and Air Traffic Control Tower controllers.

Terminal controllers in general are responsible for ensuring the separation of aircraft arriving at or departing from airports by issuing clearances (instructions regarding assigned altitudes, headings, and speeds) to pilots. When the aircraft is in a final departure or landing flight path within 3,000 feet or a radius of five miles of an airport or on the ground, controllers at ATC towers use air/ground communications, visual signaling, and other devices to provide ATC services to airborne aircraft operating very close to an airport and aircraft moving on the airport surface. The Tower controller skill set differs from those used by en route and TRACON or terminal controllers. Tower controllers direct aircraft as they land, take off, transit their control areas, and while they taxi to or from locations on the ground (e.g., gates). The functions of the tower cab controller are split into several non-overlapping positions, each responsible for a different phase of operations. The Flight Data position prepares and distributes flight data, operates the interphone system, receives and relays weather information, monitors the status of airport navigational aids, receives and relays Notices to Airmen (NOTAMS), and operates the Automatic Terminal Information Service (ATIS). The Clearance Delivery position delivers departure clearances and instructions. The Flight Data and Clearance Delivery positions are often combined. The Ground Control position issues taxi instructions to take aircraft to and from the terminal and the active runways. The Local

Control position controls aircraft on the active runway(s), issuing instructions to arriving aircraft within visual range and instructions for departing aircraft. Co-ordination between the Ground and Local positions is critical to ensure that the active runways are clear of any traffic before an aircraft actually lands or takes off.

The work of the selected contractor will be focused, for this procurement, on ATC tower cab positions.

2.2 The selection of controllers. Between 1981 and 1992, the FAA hired and trained nearly 16,000 new ATCSs to replace those fired during the 1981 strike. This concentrated period of hiring has now led to a concentrated period of retirement as individuals in the replacement workforce achieve 25 years of service. With increasing retirements, the FAA plans to hire approximately 17,000 new ATCSs between 2008 and 2017. As it may take up to 3 years to train a fully certified ATCS, the FAA's training costs are not trivial. Therefore, to meet the hiring requirements and assure that the right types of individuals are selected for subsequent training, the FAA developed and implemented the AT-SAT battery.

The AT-SAT was developed and validated through extensive research. The evaluation, development, and validation of existing and future personnel selection procedures must comply with federal statutes, regulations, guidelines, executive guidance and interpretation, relevant case law, and accepted professional standards, principles, and practices. Therefore, to comply with this legal and professional framework, the agency must (a) evaluate current employee selection procedures for conformity with the Uniform Guidelines on Employee Selection Procedures (29 CFR 1607) and the Civil Rights Act of 1964, as amended (42 USC 2000 et seq.), (b) validate those procedures against relevant measures of job performance, (c) analyze existing jobs and likely future job and knowledge, skill, and ability (KSA) requirements, and (d) develop new or enhanced selection procedures for employees, managers, and supervisors in safety-critical occupations to support the operational evolution of the NAS.

2.3 AT-SAT as a placement tool. After making a selection decision, the FAA decides into which air traffic control option a new hire will be placed. ATCS options include en route, TRACON, and tower facilities. Currently, Air traffic control hiring personnel do not have the benefit of AT-SAT data to help them make decisions about where to place a new controller candidate. The FAA's placement decisions for newly hired ATCSs are largely based on where and when vacancies occur. The FAA needs to develop a process that uses information about a new ATCS's potential to certify at a facility to decide where the new ATCS should be placed.

Interviews with instructors who train controllers in the field suggest both that some students who have aptitude for one type of controller option sometimes get placed into another option and that trainers are sometimes forced to fail students in one option when they believe that the student would have been better able to perform in a different option. Every new candidate that Human Resources places in a particular option and facility is a potential trainee washout due to not being placed in the correct option. The additional

information provided by AT-SAT would potentially maximize precision in placement allocation and reduce ineffective use of resources.

Efforts are being made by the FAA, American Institutes for Research (AIR), and Personnel Decisions Research Institute (PDRI) to validate the AT-SAT test battery for use as a placement tool. Although AT-SAT was based on worker requirements for all three controller position options, it unfortunately, has not been validated specifically for use as a placement tool. AT-SAT development and validation was carried out in several stages designed to comply with federal requirements. Computer Technology Associates, Inc (CTA) performed job/task analyses for en route, TRACON, and tower control positions in the late 1980s and early 1990s that documented the tasks controllers performed on the job. The Separation and Control Hiring Assessment (SACHA) project, conducted in the mid-1990s, used the information from the CTA job analyses to identify the general abilities needed to successfully carry out the tasks and develop predictor tests to tap the general abilities deemed most important. The final stages of AT-SAT development and validation involved the development of criterion performance measures linked to the en route controller job tasks and collection of both predictor scores and criterion performance scores from incumbent en route controllers only. These data were compared and analyzed, and the information was used to identify the specific tests to include in AT-SAT and define their weightings. AT-SAT development and validation was completed in FY00 and the battery was operationally implemented in FY02 (June), as a selection tool. As a result of the use of incumbent en route controllers and not tower controllers, it is not currently known if AT-SAT can be used as a tool to place controllers into the different options. However, the potential for AT-SAT to be used in this way has been recognized and a requirement to validate AT-SAT as a tool to inform placement decisions has been documented.

The need to evaluate the effectiveness of the AT-SAT selection battery for placement by option and develop methods to match applicant skills with optimal placement is documented in the Controller Workforce Implementation Action Plan. In the FAA Flight Plan 2006-2010, under Top Organizational Excellence Objectives for 2006-2010, Objective 1 states: "Make the organization more effective with stronger leadership, increased commitment of individual workers to fulfill organization-wide goals, and a better prepared, better trained, safer, diverse work-force." An initiative found under Objective 1 is to implement the hiring, training, staffing analysis, and management recommendations in the Air Traffic Controller Workforce Plan to support FAA's safety mission and meet external stakeholder requirements. One of the tasks specified in the associated Controller Workforce Integrated Action Plan is to evaluate the effectiveness of the AT-SAT battery for placement by option (en route, TRACON, Tower) and develop methods to match applicant skills with optimal placement. This requirement has been recognized at many levels within the Department of Transportation including the Office of Inspector General, the FAA's Aerospace Human Factors Research Division, and the Horizontal Integration Team.

Four phases must be completed to validate AT-SAT for use as a placement tool. These are: 1) update existing information regarding the activities and sub-activities performed

by the tower cab ATCS; 2) develop criterion performance measures associated with the sub-activities; 3) collect both predictor AT-SAT scores and the criterion performance data from incumbent tower ATCSs; and 4) compare and analyze the scores and performance data to determine how AT-SAT subtests should be weighted. FAA contractors AIR and PDRI are conducting phases 1, 2, and 4 and overseeing the data collection as part of phase 3. Our project is currently completing phase 2 but the work described herein will complete phase 3.

3.0 Statement of Work

3.1 Background products delivered to contractor

The performance measure software developed by the FAA and PDRI presents simulated air traffic scenarios to incumbent tower ATCSs then asks them to answer multiple-choice judgment questions about what they observed. Researchers from PDRI worked with FAA ATCS contract instructors from the University of Oklahoma and Raytheon to develop roughly 50 simulated air traffic control tower (ATCT) traffic scenarios and approximately 173 multiple-choice questions that correspond to these scenarios. The performance measure scenarios and question items are currently undergoing evaluation. It is expected that the final version of the performance measure software will take approximately 2 hours for each tower ATCS participant to complete. This development will be presented to the contractor for use in the following SOW.

Overview This statement of work requires that the contract award winner transport the simulation based performance measure, behavioral based performance ranking scales identified in 3.1, and AT-SAT equipment to 25 FAA tower facilities (referred to as hubs) and administer the two performance measures and the AT-SAT test to a total of 500 incumbent tower ATCSs. FAA staff will coordinate all site visits and participate in initial presentations.

3.2.1 Prescribed Materials and Methodology – AT-SAT

The AT-SAT test battery consists of three dynamic and five more traditional tests. The three dynamic tests are *Scan*, *Letter Factory*, and the *Air Traffic Scenarios Test*. The *Scan* test requires a candidate to track multiple targets moving on the computer screen. Targets which do not meet certain parameters must be identified before they disappear. The parameters change periodically, requiring the candidates to update the rule for identifying non-conforming targets. The *Letter Factory* test represents a factory that manufactures letters on four production lines. In the dynamic component of the test, candidates must sort letters coming off the production lines into the appropriate boxes, while maintaining correct numbers of boxes in inventory, and monitoring quality to ensure that no defective items (letters) are shipped. In the situation awareness component, candidates must answer questions about past, present, and future conditions. The *Air Traffic Scenarios Test* is a low fidelity simulation of the en route air traffic control task. In this test, candidates must direct aircraft safely and efficiently to their destinations based on a set of rules (see Broach & Brecht-Clark, 1994). ATST scores are based on efficiency, safety, and rule compliance.

The remaining 5 tests are more familiar, consisting of multiple-choice items presented on the computer screen. By using a computer to present the tests, the tests can be timed and the time it takes an examinee to respond can be collected, along with the response and other performance measures. The *Dials* test measures how quickly and accurately candidates can read and locate specific information on dials presented on a simulated aircraft instrument panel. The test presents seven dials having a total of nine scales. For the test, the examinee must quickly identify the correct reading for a specific dial from a list of five possible choices. The *Applied Math* test consists of distance, speed, and time problems couched in terms of aviation related story problems. All calculations must be made without the use of scratch paper or electronic calculators. Candidates then choose from among five possible answers. The *Angles* test measures how quickly and accurately candidates can identify angles. Items are presented either as diagrams of angles or in numeric format. Candidates must select the corresponding item from among five choices. For example, in response to a geometric figure, the examinee must select the numeric value that describes the angle. In other items, the numerical value for an angle is presented (75° , for example), and the examinee must select the corresponding graphical figure with that angle. The *Analogies* test uses both verbal and visual analogies to test the candidates' ability to reason abstractly. Verbal analogies are based on either meaning or word form. The visual analogies use abstract forms as items. The Analogies test adds a twist to this common test form by allowing the examinee to view only one part of the analogy at a time. Finally, the *Experience Questionnaire* is a self-report work habits instrument. It has 138 questions to assess the candidates' self-reported ability to work on a team, to concentrate despite distractions, to make decisions under time pressure, as well as other personal characteristics.

3.2.2 Prescribed Materials and Methodology – Criterion Performance Measure

Before the performance measure program is started, the controller participant will be given a booklet of materials including flight progress strips for the simulated flights in the scenarios and an airport map.

- Personnel charged with data collection will be trained to distribute the necessary booklet materials and how to set up, turn on, and start the performance measure hardware and software.
- Once the program has begun, ATCSs will hear recorded controller and pilot communications and will see each scenario played out on four monitors that represent the out-the-ATCT-window view and one monitor that represents the ATCT radar presentation.
- Each scenario will be played for a few moments and then be automatically paused by the program. When a scenario pauses, a sixth computer display will present relevant multiple-choice questions.
 - These air traffic scenarios are not interactive; they include scripted scenarios, not simulations.
 - Controller participants will enter their answers using the computer keyboard and those answers will be recorded to a file.

- The performance measure program will proceed to the next scenario or next question item in the sequence regardless of the multiple choice answer selected by the participants.

3.2.3 Prescribed sample size and locations

Both AT-SAT and performance measure scores shall be collected from 500 incumbent tower ATCSs. Since, we cannot transport 500 controllers to one location, data collection shall occur in cities closest to 25 different terminal hubs. Controllers at towers in the area nearby the hub city will travel to the location of the data collection to participate for approximately 2 days. The proposed list of hubs is as follows:

Los Angeles, CA
Chicago, IL
Fort Worth, TX
Miami, FL
Houston, TX
Detroit, MI
Oakland, CA
Boston, CA
Atlanta, GA
Denver, CO
Pittsburgh, PA
St. Louis, MO
Orlando, FL
Seattle, WA
Kansas City, MO
San Diego, CA
Baltimore, MD
Minneapolis, MN
Oklahoma City, OK
New York, NY
Phoenix, AZ
Las Vegas, NV
Salt Lake City, UT
Mobile, AL
Billings, MT

3.2.4 Conditions

It is anticipated that data collectors will spend approximately 2 weeks at each hub location. No more than four performance measure data collection workstations (consisting of 1 CPU and 6 monitors) will be available for use at any one time and that data collection will not take place at more than one hub location concurrently, due to the cost of the required equipment. However, these details are to be negotiated as necessary.

AT-SAT data will be collected from each of the controller participants who will also complete the performance measure. Although the time and place of data collection may

differ from operational AT-SAT data collection conducted for hiring purposes, the data collection procedure for this project will be much the same as it is for hiring. The same careful data handling and test security measures will have to be followed in both types of AT-SAT data collections.

3.3 Supplies and Services

3.3.1 Supplies/Services 1: Criterion and Predictor Data I. Contractors shall receive training regarding the setup and data collection hardware and software and administration of the criterion performance measure and the AT-SAT test battery. Contractors shall ship the data collection hardware and software to each of 8 data collection locations as specified by the FAA. Contractors shall organize the scheduling of certified professional air traffic control tower controllers volunteers at each location and administer both the criterion performance measure and the AT-SAT test battery to each volunteer.

Deliverable: Criterion Performance Measure and AT-SAT predictor data collected from no less than 160 certified professional air traffic control tower controllers.

3.3.2 Supplies/Services 2: Criterion and Predictor Data II. Contractors shall ship the data collection hardware and software to each of 8 data collection locations as specified by the FAA. Contractors shall organize the scheduling of certified professional air traffic control tower controllers volunteers at each location and administer both the criterion performance measure and the AT-SAT test battery to each volunteer.

Deliverable: Criterion Performance Measure and AT-SAT predictor data collected from no less than 180 certified professional air traffic control tower controllers over and above those delivered as part of 3.3.1.

3.3.3 Supplies/Services 3: Criterion and Predictor Data III. Contractors shall ship the data collection hardware and software to each of 8 data collection locations as specified by the FAA. Contractors shall organize the scheduling of certified professional air traffic control tower controllers volunteers at each location and administer both the criterion performance measure and the AT-SAT test battery to each volunteer.

Deliverable: Criterion Performance Measure and AT-SAT predictor data collected from no less than 160 certified professional air traffic control tower controllers over and above those delivered as part of 3.3.1 and 3.3.2.

Table 3.3 Proposed Contract Deliverables and Dates

<u>Deliverable</u>	<u>Target Dates*</u>	<u>Supplies/Services</u>
Criterion Performance Measure and AT-SAT predictor data collected from no less than 160 certified professional air traffic control tower controllers*	Award date + 110 business days	1
Criterion Performance Measure and AT-SAT	Award date +	2

<u>Deliverable</u>	<u>Target Dates*</u>	<u>Supplies/Services</u>
predictor data collected from no less than 180 certified professional air traffic control tower controllers*	200 business days	
Criterion Performance Measure and AT-SAT predictor data collected from no less than 160 certified professional air traffic control tower controllers*	Award date + 280 business days	3

*See Assumptions and Constraints below.

Data collection is to be completed by March 31, 2011*.

3.3.4 Assumptions and Constraints

The deliverables and target dates in section 3.3 depend upon the occurrence of the following dependencies which are not under the control of the contractor:

Supplies/Services 1 Dependencies: Contractors must be provided with data collection hardware and software. Contractors must be provided full training on how to set up the data collection hardware and software and administer both the criterion performance measure and the AT-SAT test battery. The FAA must have scheduled data collection to occur for at least 8 data collection locations during the time period. The scheduling of data collection must be so as to allow the contractors to spend at least two weeks at each data collection location. At least 160 certified professional air traffic controllers must volunteer to participate, be scheduled to participate, show up to the data collection location, and complete both the criterion performance measure and the AT-SAT test battery.

Supplies/Services 2 Dependencies: The FAA must have scheduled data collection to occur for at least 9 data collection locations during the time period. The scheduling of data collection must be so as to allow the contractors to spend at least two weeks at each data collection location. At least 180 certified professional air traffic controllers must volunteer to participate, be scheduled to participate, show up to the data collection location, and complete both the criterion performance measure and the AT-SAT test battery.

Supplies/Services 3 Dependencies: The FAA must have scheduled data collection to occur for at least 8 data collection locations during the time period. The scheduling of data collection must be so as to allow the contractors to spend at least two weeks at each data collection location. At least 160 certified professional air traffic controllers must volunteer to participate, be scheduled to participate, show up to the data collection location, and complete both the criterion performance measure and the AT-SAT test battery.